AN ASSESSMENT OF YOURDAMUNG AND NALYERIN LAKES IN THE JARRAH FOREST REGION OF WESTERN AUSTRALIA

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ABSTRACT

Surveys of fringing and aquatic plants, birds and aquatic macro-invertebrate species were carried out at Lake Yourdamung and Lake Nalyerin during 2002. The purpose of this survey was to determine whether Lake Yourdamung, situated on private land, was suitable for inclusion into the Lane-Poole Reserve. Results provided technical and scientific support of an application for land acquisition, which proved to be successful and the 81 ha (182 acres) property was purchased in 2004. After applying wetland functional indices to a range of wetland characteristics, Lake Yourdamung was rated as partially degraded due to draining and clearing (50%) of its fringing vegetation. Despite these interventions, it had retained good water quality and a high diversity of plant, bird and aquatic invertebrate fauna. Lake Nalyerin in comparison was in near natural condition but had suffered some degradation due to vehicle damage of the reed beds. Lake Yourdamung with some remedial restoration could in time return to a near-natural condition and form an important wetland environment, the only one on the Bingham River system. Lakes Yourdamung and Nalyerin appear to meet criteria for listing in the Directory of Important Wetlands in Australia.

INTRODUCTION

Since European settlement wetlands have been destroyed at an alarming rate either filled in or drained and used for other purposes. It is only in the past few decades that we have begun to understand the many ecological functions associated with wetlands and their significance to society (ANCA 1996). Wetlands are among the most productive ecosystems in the world and are a source of substantial biodiversity in supporting numerous species from all of the major groups of organisms – from microbes to mammals. Physical and chemical features such as climate, top-

ography, geology, nutrients, and hydrology help to determine the plants and animals that inhabit various wetlands. The combination of shallow water, high levels of inorganic nutrients, and high rates of primary productivity is ideal for the development of organisms that form the base of a dynamic food web (US EPA 2010).

Lake Yourdamung is located on the head-waters of the Bingham River at 33°12'S and 116°16'E situated some 30km north-east of Collie, Western Australia, while Lake Nalyerin, a further 10 km north east of Yourdamung at 33°08'S and 116°22'E (Figure 1), is fully within state forest on the Harris River. Lake Nalyerin provided a benchmark to compare against as it was in natural forest and has had minimal disturbance. Both Lake Nalyerin and Lake Yourdamung are natural sumpland type wetlands and as such have an important functional role. Benefits of these wetlands include water storage, flood control and help with groundwater recharge. In addition, many of the aquatic and semi-aquatic plants assist with stripping nutrients and harmful contaminants from the

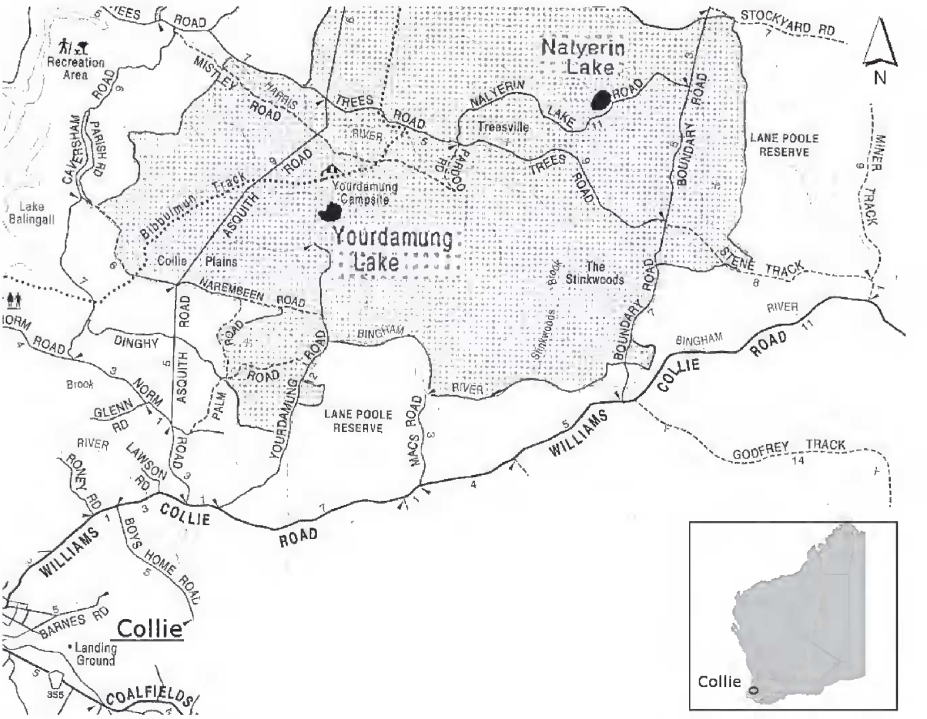

Figure 1. Location of Nalyering and Yourdamung Lakes within the Lane–Poole Reserve and their proximity to Collie, Western Australia.

water improving its quality. The wetlands also provide habitats for many plants and animals, thereby increasing species diversity. Biological monitoring of macro-invertebrate fauna is often done to assess water quality and the health of a system.

A drainage channel across the south west side effectively drained the majority of Lake Yourdamung, reducing the lake area from 30 hectares down to about one hectare. Fringing vegetation from the original lake level was still evident with a new rim of vegetation developing around the current high water-mark.

The aim of this investigation was to record and measure vegetation, birds and aquatic invertebrates for Lake Yourdamung and Lake Nalyerin and rate their health and condition. The study further aimed to determine if Lake Yourdamung would revert to natural condition forming a worthwhile addition to the State's conservation areas.

METHOD

Australia has an immense array of diversity, both physical and biological, and to describe and manage this diversity areas of similar ecosystems have been divided into biogeographic regions (ANCA 1996). Biogeographical regions are defined according to biological and environmental attributes, which include terrain, climate, geology, soil, flora and fauna. Both lakes are situated within the Jarrah forest biogeographic region, which is defined as: duricrust plateau of Yilgarn Craton characterised by Jarrah–Marri forest on laterite gravels and, in the eastern part, by Marri–Wandoo woodlands and clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands and warm Mediterranean climate (ANCA 1996). Wetlands of the Jarrah forest biogeographic region are poorly represented in the Directory of Important Wetlands in Australia (Environment Australia 2001). Only seven wetlands / wetland systems have been listed in the directory as being of national significance. All of these are on the periphery of the region, with five along the southern edge and two on the northern tip.

A visit to the lakes was conducted on the 20 November 2002 to sample plant material for identification and species listing of fringing and aquatic plants (See Appendix 1 for plant species, Appendix 3 for cryptogams). The fringing vegetation area sampled was between the high water mark and the lake edge. Aquatic and semi-aquatic plants from within the lake were also included along with cryptogams. Voucher specimens for study were collected from plants flowering at the time of the survey and returned to the laboratory, where they were processed and later sent to

the Western Australian Herbarium. A rapid assessment technique rated the condition of the fringing vegetation and provided a comparative species listing to determine the level of degradation and species composition for both lake systems

Aquatic macro-invertebrate taxa were quantified to determine water quality and lake condition at Yourdamung Lake, whereas only a visual inspection was done at Lake Nalyerin due to time constraints. The method used a timed survey technique where sweeps of the water from surface to lakebed with a fine mesh net were conducted over a 20-second period. Ten sweeps placed at random locations around the lake produced sample specimens, which were returned to the laboratory. Identification of specimens using available keys provided a list of species which, together with a measure of their abundance, were applied to tables published by Davis and Christidis (1997) to determine water quality and the health of the system.

Bird counts of fringing and in-lake vegetation at Lake Yourdamung assessed numbers of bird species. The assessment used the standard Birds Australia point transect method (Davies 1983) and sightings and sounds of bird species were recorded at points around the lake. A bird list for Lake Yourdamung is presented in Appendix 2.

Analysis

Data from both lakes (Nalyering and Yourdamung) was applied to a functional capacity rating system which assesses each attribute separately by applying a score based on its condition. All scores are added together to provide an overall total which is compared with a standard. This produces a functional capacity index derived by the following equation for the wetland (adapted from Smith *et al.* 1995) (see Table 3).

FCI = Functional capacity measured / Functional capacity standard

RESULTS

Vegetation species data collected for fringing and aquatic plants are summarised for lakes Yourdamung and Nalyerin in Table 1.

A comparison of the fringing vegetation for both lakes, shows Lake Yourdamung to have

Table 1. Number of fringing and aquatic vegetation species in each lake

	Total number of species	Species common to both	Weed species
Lake Yourdamung	87	19	28
Lake Nalyerin	50	19	2

significantly more weed species than Lake Nalyerin. This is not surprising given that up to 50% of the fringing vegetation was removed to provide pasture for grazing, allowing 28 exotic grasses and weeds to become established compared with only two weeds at Lake Nalyerin. Once the weed species were deducted from the species list there was a similar level of species with Lake Yourdamung having slightly higher species numbers. However, only 19 species are common to both lakes and this shows that these two lakes have dramatically different species composition even though they are only 10km apart.

At sweep sites 'Yourdamung', 10 aquatic invertebrate taxa were present in low numbers and of a type consistent with good water quality (Davis and Christidis 1997) (Table 2). Time allowed for only a visual inspection of Lake Nalyerin, which showed a high abundance of shrimp and other crustaceans that are sensitive to pollution and are species consistent with a healthy system.

Table 2. Macro-invertebrate taxa and abundance at Yourdamung Lake.

	Taxa	Abundance
Caddis fly	Trichoptera	1
Clam shrimp	Mollusca	40
Mites	Arichnida	15
Backswimmer	Hemiptera	10
Beetle	Coleoptera Sp1	5
Beetle	Coleoptera Sp2	3
Dragonfly	Odonata	2
Midges	Diptera	6
Worms	Oligochaeta	20
Mosquitoes	Diptera	2

Bird counts using standard bird census techniques over two mornings at Yourdamung returned a species list of 74 birds (See Appendix 3 for complete list).

Water quality was measured twice at Lake Yourdamung during 2002, in July a period of maximum dilution and again in December during the peak of concentration. The results show; pH ranging from 6.0 in July to 7.49 in December and conductivity from 104 to 177 µS/cm (0.06–0.1ppt) respectively. The dissolved oxygen concentration was 83% in July. The pH of Lake Yourdamung is slightly acidic but well within the range of values reported for other lakes in South-Western Australia (Lane *et al.* 2004, 2011), most of which are more alkaline, probably due to differences in soils and vegetation. Salinity values are very low compared with those of most South West Wetland Monitoring Program (SWWMP) wetlands, as is typical in the Jarrah forest. Lake Yourdamung had a maximum depth in its current state of about 1m, which is lower than that of most SWWMP wetlands.

A functional capacity index of each lake was calculated from wetland attributes that rated the level of degradation and compared against a standard value (Table 3). The functional capacity index was determined by entering the total of all ratings into

Table 3. Showing functional capacity index for both lakes compared with the standard for each function

Function	standard	Yourdamung index	Nalyerin index	Comments
Water storage	1.0	0.5	1.0	Yourdamung drained
Nutrient cycling	1.0	0.8	1.0	Intact aquatic vegetation
Removal of compounds	1.0	0.6	1.0	Area at Yourdamung reduced
Organic carbon	1.0	0.6	1.0	Area of Yourdamung reduced
Maintain plant community	1.0	0.9	0.9	
Maintain detrital biomass	1.0	0.9	1.0	
Spatial structure of habitat	1.0	0.6	1.0	
Connectivity	1.0	0.3	1.0	
Abundance of invertebrates	1.0	0.9	0.9	
Abundance of vertebrates	1.0	0.9	0.9	
Water quality	1.0	0.9	0.9	
Total	11.0	7.9	10.6	

the equation from Smith *et al.* (1995).

FCI = Functional capacity measured / Functional capacity standard

Lake Yourdamung = 7.9/11 gives a FCI of 0.71

Lake Nalyering = 10.6/11 gives a FCI of 0.96

A wetland in pristine condition would have a score of 1.0 and both lakes rated highly.

DISCUSSION

The fringing vegetation is subject to inundation annually and forms a natural filtration system that strips and retains nutrients and harmful pollutants from the water improving water quality discharged into the river system. Comparison of plant diversity for both lakes show the numbers of species to be similar but they have distinctly different species composition and this highlights the spatial differences between the two catchments. Lake Yourdamung has more species with higher levels of grasses and weeds, which has resulted from disturbance associated with clearing to produce pastured land. This lake although cleared of some of its fringing vegetation has maintained good water quality and a high diversity of plant, bird and aquatic invertebrate species. The land surrounding the lake is mostly pastured farmland with a narrow strip of vegetation upstream that provides some connectivity to the natural forest to the north.

The areas cleared would easily revert to natural vegetation and already show some evidence of sedges and reed beds becoming established, an observation noted during the initial visit and a subsequent visit during 2010. Lake Nalyerin in comparison is in near-natural condition but has some damage due to vehicle traffic crossing reed beds. Some remedial action could rectify this area by resiting tracks and access points.

Lake Yourdamung appears to meet Criteria for listing in the Directory of Important Wetlands in Australia. Such as, *It is a good example of a wetland type occurring within a biogeographic region in Australia* but, due to a lack of data demonstrating national significance at the time of assessment of wetlands in this region (J. Lane, pers. comm., 3 March 2011), has not been listed. Lake Yourdamung is also not included among the 152 wetlands of the Department of Environment and Conservation's 'South West Wetlands Monitoring Program' which, for historical reasons, has an emphasis on wetlands of the wheatbelt and the coastal plains. Most lakes in this monitoring program are within national parks or nature reserves established prior to 2000 (Lane *et al.* 2004, 2011). The Lake Yourdamung property was within, but not part of, the Lane-Poole Reserve and had many reasons why it should be added to the reserve. These include: it has a high diversity of plant, bird and animal species; it can be restored back to a natural state; it is within the boundaries of the Lane–Poole Reserve; and it contains habitat suitable for the reintroduction of rare fauna such as Tammar, Woylie and Chuditch also lakes listed in the Directory of Important Wetlands in Australia are poorly represented in the Jarrah forest biogeographical region. Combined, these reasons provided compelling biological evidence to support the application for land acquisition which was finally achieved in 2004.

Restoration of Lake Yourdamung

A priority following land acquisition was to destock the property of cattle and sheep. This significantly reduced grazing pressure allowing natural vegetation to re-establish. As part of the farming activities, a drain cut on the south-eastern edge effectively lowered the lake by 0.8–1.0m altering the entire hydrology of the lake. The lake originally covered about 36 hectares and because of drainage, only about one hectare holds water and actively functions as a sump. To restore this lake to its natural level, forms the next priority and can be achieved by filling in or blocking the drain. Restoration of the damaged fringing vegetation would develop naturally but intervention in the form of replanting and infilling of the vegetation would speed this process. The cost of this type of intervention often

prohibits this work.

There was evidence of water birds nesting and foraging in the water during our visit and suggests that this is an important site for many of these species. Lane–Poole Reserve has 120 species of birds and this survey has captured over 60% from this one site, which emphasises its importance. Increasing the area of the lake back to its original size would benefit these species providing increased habitat and maintenance of diversity. Despite the draining and clearing of the lake, the health of this system is in good order. Evidence of this was shown by the cover of aquatic and semi-aquatic plants, with good water quality capable of supporting growth and a suite of macroinvertebrate fauna recognised for their capacity to only survive in good quality water. The water was clear and contained no evidence of algal blooms.

Lake Yourdamung drains into the Bingham River through a broad valley flat that is subject to inundation. The lake forms a natural sump and experiences a strong seasonal hydrological cycle of flooding during winter while drying out in summer and is typical of the natural wetlands found in the Jarrah forest. Once restored, it will play a substantial ecological role in the natural functioning of the river system. Restoration of the lake and maintenance of the river system is a responsible goal to preserve the long-term viability of this important habitat and its ecological diversity.

CONCLUSION

Lake Yourdamung showed partial impact from farming and has a high diversity of plant, bird and aquatic animals with fringing vegetation forming an important habitat which would regenerate over time. The property containing the majority of the lake was purchased and incorporated into the Lane–Poole Reserve and will form an important natural wetland for this area.

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REFERENCES

CHRISTIDIS, L. AND W.E. BOLES 2008. *Systematics and Taxonomy of Australian Birds.* CSIRO Publishing, Melbourne

DAVIES, S.J.J.F. 1983. Methods of censusing birds in Australia. Proceedings of a symposium organised jointly by the Zoology section of the ANZAAS and the Western Australian group of the Royal Australasian Ornithologists

Union. ED S.J.J.F. Davies. Department of Conservation and Environment, Perth, W.A. Bulletin 153.

DAVIS, J. AND CHRISTIDIS, F. 1997. *A Guide to Wetland Invertebrates of South Western Australia.* Published by the West Australian Museum.

ENVIRONMENT AUSTRALIA. 2001. *A Directory of Important Wetlands in Australia, Third Edition.* Environment Australia, Canberra. http://www.environment.gov.au/water/topics/wetlands/database/diwa.html

LANE, J. CLARKE, A. AND WINCHCOMBE, Y. 2011. *South West Wetlands Monitoring Program report: 1977 – 2010.* Western Australian Department of Environment and Conservation. 156pp.

LANE, J., PEARSON, G., CLARKE, A., WINCHCOMBE, Y. AND MUNRO, D. 2004. *Depths and salinities of wetlands in south-western Australia: 1977–2000.* WA Department of Conservation & Land Management. 129pp.

SMITH, D. AMMANN, A., BARTOLDUS, C. AND BRINSON, M. 1995. *An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands and Functional Indices.* Technical Report WRP-DE-9 October 1995. Prepared for U.S. Army Corps of Engineers Washington DC

US EPA. 2010. U.S. Environmental Protection Authority Watershed Academy Web http://www.epa.gov/owow/watershed/wacademy/acad2000/wetlands/index.htm Accessed 31 Dec 2010.

APPENDIX 1. (Vegetation species from Lakes Yourdamung and Nalyering in 2002). Genus marked with an asterisk is a weed species

		Lake Yourdamung	Lake Nalyering	
Amaranthaceae		*		
Alternanthera	*nodiflora*			
Apiaceae				
Daucus	*glochidiatus*	*	*	
Homalosciadium	*homalocarpum*	*	*	
Araliaceae				
Trachymene	*pilosa*	*	*	
Asparagaceae				
Chamaescilla	*corymbosa*	*	*	
Sowerbaea	*laxiflora*	*		
Thysanotus	*tenellus*		*	
Asteraceae				
**Arctotheca*	*calendula*	*		
**Cotula*	*coronopifolia*	*		
Helichrysum	*luteoalbum*	*		
**Hypochaeris*	*glabra*	*	*	
Lagenophora	*huegelii*		*	
Senecio	*quadridentatus*		*	
Siloxerus	*humifusus*	*	*	
**Sonchus*	*asper*	*		
**Sonchus*	*oleraceus*	*		
Campanulaceae				
Lobelia	*anceps*	*	*	
**Monopsis*	*debilis*	*		
Wahlenbergia	*gracilenta*	*	*	
Centrolepidaceae				
Aphelia	*cyperoides*	*		
Centrolepis	*aristata*		*	
Characeae				
Chara	sp.		*	algae
Crassulaceae				
**Crassula*	*natans*	*		
Cyperaceae				
Baumea	*articulata*		*	
Baumea	*juncea*		*	
Isolepis	*cyperoides*	*		
**Isolepis*	*marginata*	*		
Isolepis	*stellata*	*		
Dilleniaceae				
Hibbertia	*amplexicaulis*		*	
Hibbertia	*racemosa*	*	*	
Hibbertia	*stellaris*	*		
Elaeocarpaceae				
Platytheca	*galioides*	*		

Appendix 1 (cont.)

				Lake Yourdamung	Lake Nalyering
Ericaceae					
Brachyloma	*geissoloma*			*	
Leucopogon	*capitellatus*			*	
Leucopogon	*propinquus*				*
Leucopogon	*verticillatus*			*	
Fabaceae					
Acacia	*huegelii*			*	
Acacia	*pulchella*			*	
Bossiaea	*linophylla*				*
Eutaxia	*virgata*			*	
Gastrolobium	*ebracteolatum*				*
Gompholobium	*capitatum*			*	
Jacksonia	*furcellata*			*	
**Lotus*	*subbiflorus*			*	
**Trifolium*	*dubium*			*	
**Trifolium*	*subterraneum*			*	
Viminaria	*juncea*				*
Geraniaceae					
Pelargonium	*littorale*			*	
Goodeniaceae					
Dampiera	*linearis*			*	
Goodenia	*filiformis*			*	*
Haemodoraceae					
Conostylis	*aculeata*				*
Haloragaceae					
Myriophyllum	*crispatum*			*	
Myriophyllum	*drummondii*			*	
Hemerocallidaceae					
Caesia	*micrantha*			*	*
Dianella	*revoluta*			*	
Hydrocharitaceae					
Ottelia	*ovalifolia*			*	
Iridaceae					
Patersonia	*occidentalis*			*	
Patersonia	*umbrosa*	var.	*umbrosa*	*	
Juncaceae					
**Juncus*	*microcephalus*			*	
Juncus	*pauciflorus*			*	
Lamiaceae					
**Mentha*	*pulegium*			*	
Lauraceae					
Cassytha	*racemosa*				*
Lentibulariaceae					
Utricularia	*volubilis*				*

				Lake Yourdamung	Lake Nalyering
Loganiaceae					
Phyllangium	*paradoxum*			*	*
Lythraceae					
**Lythrum*	*hyssopifolia*			*	
Menyanthaceae					
Ornduffia	*parnassifolia*			*	*
Myrtaceae					
Astartea	*fascicularis*			*	
Corymbia	*calophylla*			*	
Eucalyptus	*marginata*			*	
Eucalyptus	*rudis*			*	*
Hypocalymma	*angustifolium*			*	
Kunzea	*glabrescens*			*	
Kunzea	*spathulata*				*
Melaleuca	*lateritia*			*	*
Melaleuca	*preissiana*			*	*
Melaleuca	*viminea*			*	*
Onagraceae					
Epilobium	*billardiereanum*	subsp.	*cinereum*	*	
Orchidaceae					
**Disa*	*bracteata*			*	
Elythranthera	*emarginata*				*
Microtis	*brownii*				*
Microtis	*media*	subsp.	*media*	*	*
Microtis	*orbicularis*				*
Thelymitra	*crinita*				*
Orobanchaceae					
**Orobanche*	*minor*			*	
Phyllanthaceae					
Poranthera	*microphylla*				*
Pittosporaceae					
Billardiera	*heterophylla*				*
Poaceae					
**Aira*	*cupaniana*			*	
Amphibromus	*nervosus*			*	
**Briza*	*maxima*			*	
**'Briza*	*minor*			*	
**Bromus*	*hordeaceus*			*	
**Holcus*	*lanatus*			*	
**Hordeum*	*leporinum*			*	
**Lolium*	*rigidum*			*	
Microlaena	*stipoides*				*
Neurachne	*alopecuroidea*			*	
**Polypogon*	*monspeliensis*			*	
**Rostraria*	*cristata*			*	
**Vulpia*	*bromoides*			*	

Appendix 1 (cont.)

		Lake Yourdamung	Lake Nalyering
Polygonaceae			
Persicaria	*prostrata*	*	
**Rumex*	*brownii*	*	
Proteaceae			
Banksia	*attenuata*		*
Banksia	*littoralis*	*	
Hakea	*prostrata*		*
Hakea	*varia*	*	
Persoonia	*longifolia*	*	
Ranunculaceae			
Ranunculus	*amphitrichus*		*
Rosaceae			
**Acaena*	*echinata*		*
Rutaceae			
Boronia	*dichotoma*	*	
Stylidiaceae			
Levenhookia	*dubia*	*	
Levenhookia	*pusilla*		*
Stylidium	*brunonianum*	*	*
Stylidium	*induratum*	*	
Stylidium	*inundatum*		*
Stylidium	*roseoalatum*	*	
Stylidium	sp.		*
Typhaceae			
**Typha*	*orientalis*	*	
Xanthorrhoeaceae			
Xanthorrhoea	*preissii*	*	
Zamiaceae			
Macrozamia	*riedlei*		*

APPENDIX 2. Birds of Yourdamung Lake

RAOU	Common Name	Scientific Name
001	Emu	*Dromaius novaehollandiae*
035	Brush Bronzewing	*Phaps elegans*
046	Buff-banded Rail	*Gallirallus philippensis*
056	Dusky Moorhen	*Gallinula tenebrosa*
057	Purple Swamphen	*Porphyrio porphyrio*
097	Little Black Cormorant	*Phalacrocorax sulcirostris*
100	Little Pied Cormorant	*Phalacrocorax melanoleucos*
179	Australian White Ibis	*Threskiornis molucca*
182	Yellow-billed Spoonbill	*Platalea flavipes*
188	White Faced Heron	*Ardea novaehollandiae*
189	Pacific Heron	*Ardea pacifica*
203	Black Swan	*Cygnus atratus*
207	Australian Shelduck	*Tadorna tadornoides*
208	Pacific Black Duck	*Anas superciliosa*
210	Chestnut Teal	*Anas castanea*
211	Grey Teal	*Anas gibberifrons*
212	Australasian Shoveler	*Anas rhynchotis*
217	Musk Duck	*Biziura lobata*
218	Spotted Harrier	*Circus assimilis*
219	Swamp Harrier	*Circus approximanis*
221	Brown Goshawk	*Accipiter fasciatus*
222	Collared Sparrowhawk	*Accipiter cirrhocephalus*
224	Wedge-tailed Eagle	*Aquila audax*
235	Australian Hobby	*Falco longipennis*
237	Peregrine Falcon	*Falco peregrinus*
240	Australian Kestrel	*Falco cenchroides*
242	Southern Boobook	*Ninox novaeseelandiae*
264	Red-tailed Black Cockatoo	*Calyptorhynchus magnificus*
266	White-tailed Black Cockatoo	*Calyptorhynchus latirostis*
289	Western Rosella	*Platycercus icterotis*
290	Red-capped Parrot	*Purpureicephalus spuruius*
294	Port Lincoln Ringneck	*Barnardius zonarius semitorquatus*
307	Elegant Parrot	*Neophema elegans*
313	Tawny Frogmouth	*Podargus strigoides*
322	Laughing Kookaburra	*Dacelo novaeguineae*
326	Sacred Kingfisher	*Halcyon sancta*
329	Rainbow Bee-eater	*Merops ornatus*
344	Shining Bronze Cuckoo	*Chrysococcyx lucidus*
347	Richard's Pipit	*Anthus novaeseelandiae*
359	Tree Martin	*Cecropis nigricans*
361	Grey Fantail	*Rhipidura fuliginosa*
364	Willie Wagtail	*Rhipidura leucophrys*
369	Restless Flycatcher	*Myiagra inquieta*
380	Scarlet Robin	*Petroica multicolor*
381	Red-capped Robin	*Petroica goodenovii*
384	Western Yellow Robin	*Epopsaltria grisogularis*

Appendix 2 (cont.)

RAOU	Common Name	Scientific Name
398	Golden Whistler	*Pachycephala pectoralis*
408	Grey Shrike-thrush	*Colluricincla harmonica*
415	Australian Magpie-lark	*Grallina cyancoleuca*
424	Black-faced Cuckoo shrike	*Coracina novaehollandiae*
430	White-winged Triller	*Lalage sueurii*
448	White-fronted Chat	*Ephthianura albifrons*
463	Western Gerygoyne	*Gerygone fusca*
472	Western Thornbill	*Acanthiza inornata*
476	Inland Thornbill	*Acanthiza apicalis*
486	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
524	Clamorous Reed-warbler	*Acrocephalus stentoreus*
532	Spendid Fairy-wren	*Malurus splendens*
547	Dusky Woodswallow	*Artamus cyanopterus*
565	Spotted Pardalote	*Pardalotus punctatus*
574	Silvereye	*Zosterops lateralis*
578	White-naped Honeyeater	*Melithreptus lunatus*
592	Western Spinebill	*Acanthorhynchus superciliosus*
597	Brown Honeyeater	*Lichmera indistincta*
608	Singing Honeyeater	*Lichenostomus virescens*
631	New Holland Honeyeater	*Phylidonyris novaehollandiae*
637	Little Wattlebird	*Anthochaera chrysoptera*
638	Red Wattlebird	*Anthochaera carunculata*
651	Red-eared Firetail	*Emblema oculata*
697	Grey Currawong	*Strepera versicolor*
702	Grey Butcherbird	*Cracticus torquatus*
705	Australian Magpie	*Gymnorhina tibicen*
930	Australian Raven	*Corvus coronoides*
976	Striated Pardalote	*Pardalotus striatus*

APPENDIX 3. Mosses and Lichens (Cryptogams) of Yourdamung Lake

FAMILY_NAME	GENUS	SPECIES	Life Form
Cladoniaceae	*Cladia*	*aggregata*	lichen
Collemataceae	*Collema*	*leucocarpum*	lichen
Hypogymniaceae	*Menegazzia*	*caesiopruinosa*	lichen
	Menegazzia	*fertilis*	lichen
Lecanoraceae	*Maronina*	*hesperia*	lichen
Lecanoraceae	*Pyrrhospora*	*laeta*	lichen
Lecanoraceae	*Tephromela*	*alectoronica*	lichen
Lecideaceae	*Lecidea*	*capensis*	lichen
Lecideaceae	*Lecidea*	*tragorum*	lichen
Lichinaceae	*Pyrenopsis*	sp. (D. Richardson 962)	lichen
Parmeliaceae	*Flavoparmelia*	*marchantii*	lichen
Parmeliaceae	*Parmotrema*	*cooperi*	lichen
Parmeliaceae	*Xanthoparmelia*	*fumigata*	lichen
Parmeliaceae	*Xanthoparmelia*	*nana*	lichen
Parmeliaceae	*Xanthoparmelia*	*oleosa*	lichen
Peltulaceae	*Peltula*	*obscurans*	lichen
Pertusariaceae	*Ochrolechia*	*pallescens*	lichen
Pertusariaceae	*Pertusaria*	*scaberula*	lichen
Physciaceae	*Amandinea*	*punctata*	lichen
Physciaceae	*Buellia*	*disciformis*	lichen
Physciaceae	*Buellia*	*dissa*	lichen
Ramalinaceae	*Ramalina*	*inflata*	lichen
Sematophyllaceae	*Sematophyllum*	*subhumile*	moss
Usneaceae	*Usnea*	*dasaea*	lichen
Usneaceae	*Usnea*	*subalpina*	lichen